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Assessing Programs Designed to Eliminate Health Challenges Among Young Children

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ABSTRACT

***Aim**: The aim of this study is to examine the effectiveness of structured intervention programs in improving physical and mental health outcomes among physically inactive children aged seven to twelve years.*

Purpose: The purpose of the research is to address the rising concern of childhood inactivity and its related health risks, such as obesity, cardiovascular diseases, and behavioral issues, by identifying and evaluating strategies that promote regular physical activity.

Methodology**: A systematic literature review (SLR) was conducted to explore existing evidence-based interventions, followed by a pre- and post-test experimental design involving 200 children, equally divided by gender into two groups, who participated in a six-month structured physical **activity program.

***Findings**: The results showed significant improvement in both physical and mental health among participants after the intervention, indicating the effectiveness of targeted physical activity initiatives in reducing inactivity and enhancing overall well-being.*

Conclusion: The study concludes that early-age intervention programs are crucial for preventing long-term health complications associated with physical inactivity, and it provides relevant limitations and recommendations to guide future research.

***Keywords**: Politics of Crises, Framing of Migration, Policy, Public Perception.*

Introduction

The growing concern surrounding mental health and overall well-being has gained increasing attention among researchers and health experts, largely due to the alarming rise in global physical inactivity. Approximately 85% of the world's population fails to meet the World Health Organization (WHO) guidelines for physical activity. Technology-based approaches such as smartphones, social media platforms, exergames, and wearable devices have demonstrated potential to promote physical activity through enhanced engagement and learning (Guthold et al., 2020). However, technology use among young populations has also increased dramatically; for instance, in the United Kingdom, 93% of children aged 8–10 spend around 13 hours per week online, while 99% of adolescents aged 12–15 spend nearly 20 hours weekly on digital platforms for various purposes, including education and entertainment, which may negatively influence physical activity levels (Koekoek & Van Hilvoorde, 2019).

Mental health and well-being are closely interconnected and influenced by both positive and negative psychological factors. Negative indicators include depression and anxiety, whereas positive indicators encompass self-esteem and self-concept. Evidence suggests a growing prevalence of poor mental health among young people; for example, symptoms of depression and anxiety have increased among Canadian students from grade seven onwards (Boak et al., 2018). In response, mental health promotion strategies emphasize the importance of physical activity as a protective and therapeutic factor. Numerous studies highlight the benefits of

physical activity (PA) for youth (Faulkner & Duncan, 2017; Poitras et al., 2016), yet research focusing specifically on children remains limited.

Mental health among children is often assessed through key indicators such as depression, anxiety, and self-esteem. Prior literature shows significant associations between physical activity and reduced symptoms of depression and anxiety. Additionally, self-esteem has been identified as a protective factor against mental illness, with systematic reviews demonstrating a positive relationship between physical activity and self-esteem among children and youth (Ahn & Fedewa, 2011). Although previous studies suggest that physical activity reduces depressive symptoms and helps regulate anxiety, gaps remain regarding how and to what extent physical activity influences children's mental health. Further research is needed to address missing mechanisms and contributing factors that trigger negative emotional states (Dale et al., 2019).

Background

Lifestyle patterns have shifted considerably across age groups, especially among children. Unlike previous generations, today's children spend significant time using digital devices, limiting opportunities for physical movement. Reduced physical activity compromises both physical and mental health as well as cognitive functioning. This issue has intensified in recent years, with increased behavioral challenges such as depression and anxiety. Scholars emphasize the urgent need for holistic health promotion initiatives within families and schools to foster supportive, physically active environments (Cox et al., 2016). Insufficient physical activity contributes to numerous health risks, including poor posture, somatic complaints, obesity, impaired blood circulation, and in severe cases, premature mortality. Evidence indicates that inactivity heightens vulnerability to mental disorders, weight-related problems, and behavioral risks such as substance abuse and suicidal tendencies (Lipowski & Zaleski, 2015; Lipowski et al., 2016).

Mental health concerns among children and adolescents particularly depression, anxiety, and low self-esteem are widely documented. Self-esteem plays a critical role in emotional stability and psychological well-being. Research across developed countries such as Ireland, Portugal, Germany, and Finland shows high rates of depression among youth. In the United Kingdom, 19.7% of individuals under 16 report symptoms of anxiety or depression, with annual increases of approximately 1.5%, particularly among females. Additionally, growing rates of overweight and obesity due to physical inactivity further contribute to health and behavioral risks, including substance addiction and suicidal ideation (Biddle et al., 2019).

Health-related problems among children and adolescents worldwide are strongly linked to insufficient physical activity. Many children under the age of 11 do not meet recommended activity levels, and this trend is consistent across countries, regions, and genders. This situation represents a serious threat to both present and future health outcomes. As a result, effective policies and structured initiatives that promote physical activity are urgently needed to address these health concerns (Ekelund et al., 2019). Physical activity offers multiple benefits for youth, and comprehensive research is required to develop strategies that increase awareness and encourage regular participation. Rising childhood obesity fueled by minimal physical activity and excessive caloric intake has become a major public health concern. Obesity contributes to metabolic and cardiovascular disorders during childhood and later adulthood (Karuc & Mišigoj-Duraković, 2019). In some regions, such as Italy, dietary habits involving high sugar and fat intake combined with sedentary behavior significantly contribute to weight gain (Battaglia et al., 2021). Additionally, overweight and obesity among children often reflect obesogenic family environments, including parental weight-related behaviors (Bülbül, 2020).

Health promotion strategies

Programs designed to promote health-related initiatives can significantly enhance exercise engagement through structured movement, yielding positive effects on overall health and lifestyle. Implementing such strategies during childhood helps reduce overweight prevalence and associated negative health behaviors, prevents obesity, and provides long-term health benefits (Yuksel et al., 2020). For example, the Italian Ministry of Health introduced exercise guidelines emphasizing essential activities to support bone and joint health, muscular development, weight control, cardiovascular function, and respiratory efficiency in children. Despite these guidelines, children often struggle to adhere to them due to prolonged hours in educational institutions. Therefore, establishing health-promotion initiatives within academic settings is critical for fostering healthy lifestyles, reducing negative health factors, and enhancing cognitive, mental, and functional development (Claver et al., 2017).

Plyometric training is widely recognized as a vital component of health-enhancement strategies, as it improves muscular strength, power, endurance, bone density, body composition, motor skills, and lipid profile efficiency (Behm et al., 2017). Research indicates that combining traditional resistance training with plyometric exercises is more effective in improving performance than resistance training alone, benefiting activities such as long jump, ball toss, and shuttle runs. Complex training, which integrates both resistance and plyometric exercises, has been shown to significantly increase upper- and lower-body explosivity, making it particularly advantageous for sports like basketball (Fischetti et al., 2019).

Plyometric exercises involve multi-joint movements, including leaping, hopping, and skipping, which utilize the stretch-shortening cycle, encompassing an eccentric phase (rapid muscle stretch) followed by a concentric phase (immediate shortening). While concerns exist regarding the risk of injury, evidence suggests that safe and well-structured programs offer substantial health and fitness benefits for youth, enhancing motor abilities, running, hopping, throwing, and overall dynamic strength (Almeida et al., 2021; Peitz et al., 2018).

Inactivity is a leading factor contributing to poor health and increased mortality worldwide. Global trends indicate a rising prevalence of sedentary behavior, which is strongly associated with noncommunicable diseases. Current recommendations suggest at least 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity exercise per week. Regular movement is proven to improve muscular and cardiorespiratory fitness, functional capacity, and mental health while reducing the risk of disease (Romeo et al., 2019).

The importance of exercise for children is well-established, offering both physical and psychological benefits. In recent years, sedentary behavior has emerged as a major public health concern due to its negative impact on academic performance and overall well-being. Aerobic exercises, in particular, enhance executive functioning and contribute to cognitive development, creativity, and scholastic achievement (Román et al., 2018; Kao et al., 2017). Studies show that children with higher aerobic fitness levels demonstrate superior academic performance compared to their less-fit peers (Alvarez-Bueno et al., 2020).

Participation in exercise provides numerous health benefits, including improved cardiovascular health, metabolic function, motor skills, bone density, and psychological well-being. However, less than 10% of children in educational settings achieved recommended activity levels during the COVID-19 pandemic, highlighting a significant public health concern (Bates et al., 2020). Insufficient movement is associated with increased risk of obesity, cardiovascular disease, diabetes, and mental health disorders. Research also indicates a strong positive effect of sports and structured exercise on children's physical, mental, and cognitive development (Haverkamp et al., 2020; Bidzan-Bluma & Lipowska, 2018). The present study aims to raise awareness of

these issues and develop holistic programs within academic environments to promote movement and healthy behaviors.

High-intensity functional training (HIFT) combines joint movements, aerobic exercises, and muscle-strengthening activities and can be adapted to different fitness levels. HIFT engages multiple muscle groups and improves cardiovascular endurance, muscular strength, and flexibility. Previous studies have explored HIFT using diverse exercise modalities, including mono-structural activities (e.g., running, rowing), bodyweight movements (e.g., squats, push-ups), and weightlifting exercises (e.g., snatch, shoulder press, deadlift), emphasizing progressive work capacity and overall functional fitness improvements (Feito et al., 2018).

Methods

A comprehensive literature search was conducted in October 2024 across multiple electronic databases, including EBSCO (AMED, CINAHL Plus, Health Source, MEDLINE, APA PsycArticles, Psychology and Behavioral Science Collection), ProQuest, PubMed, Scopus, Web of Science, and Health Business. The review focused exclusively on research articles published in English, with a defined publication time frame, and aimed to include the maximum number of relevant studies.

A structured search strategy was employed using a combination of keywords to retrieve relevant studies, including: ("mental health" OR "physical health" OR "mental and physical health in school-aged children" OR "physical fitness" OR "sports participation" OR "sedentary behavior" OR "exercise behavior" OR "behavioral change" OR "fitness programs" OR "child health" OR "aerobic exercise" OR "resistance training" OR "plyometric training" OR "functional training" OR "accessible, attractive, affordable, and attainable exercise programs" OR "inactive children"). The detailed results of the search strategy and selected studies are presented in Table 1.

Table 1: Research Screening

Database & Date Range	Search items	Specific limit	Number of records
ProQuest (2015-2024)	Physical activity, polymetric training, fitness programs, physical activity, mental health, inactive children	Peer reviewed, document language English	2891
PubMed Central	Physical inactive, polymetric training, aerobic training, physical exercise, inactive children	Published in English, scholarly articles	1103
SCOPUS	Physical activity, inactive children, mental health, aerobic, functional, polymetric, resistance training, physical training, interventions	Published in English, scholarly article	1203
Web of Science	Physical fitness,	English scholarly	951

	sports, physical activity behavior, physical fitness program, exercise intervention, children' health, aerobic, resistance, polymetric, functional training, inactive children	articles	

The search items were reported according to Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) for article screening process in figure 1.

Inclusion Criteria: Papers

1) Availability of full text, 2) Research participants physically inactive children, 3) Research on physical activity, 4) written in English, 5) published in scholarly journals

The **figure 1** shows the inclusion criteria diagram

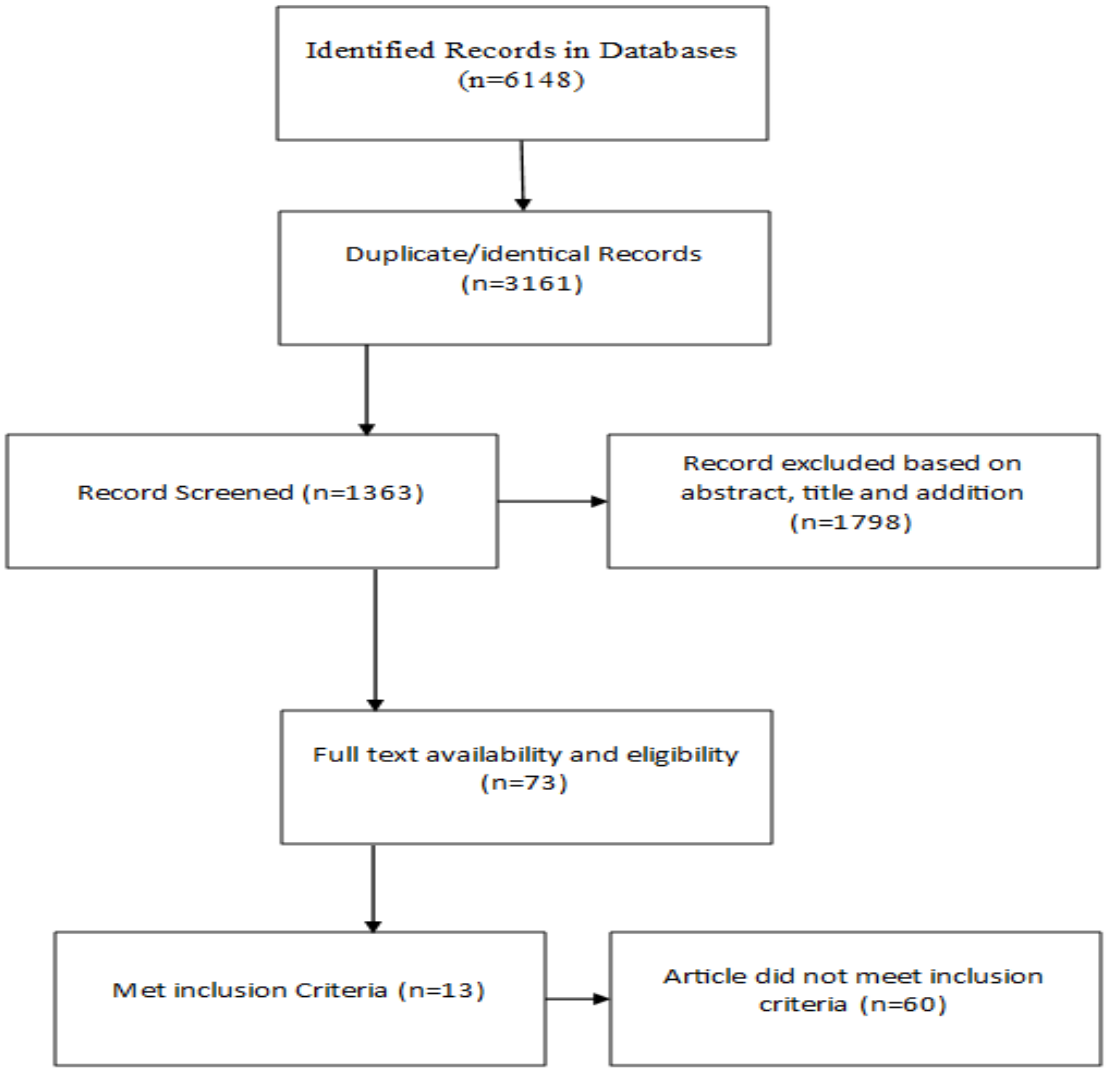


Figure 1: Inclusion Criteria of Databases

Eligibility Criteria: Study Subjects

The researcher focused on 200 children, aged between 9 to 12 years belongs to different schools. These schools were never participated in health promotion related to public sector domain with higher attendance. The sample consists of boys (100) and girls (100), who were in group of 50 each in a group. All of the children were free from any kind of disability and were healthy in terms of cariological, neurological or respiratory diseases or dysfunction. Figure 2 presents the PRISMA diagram of participants criteria.

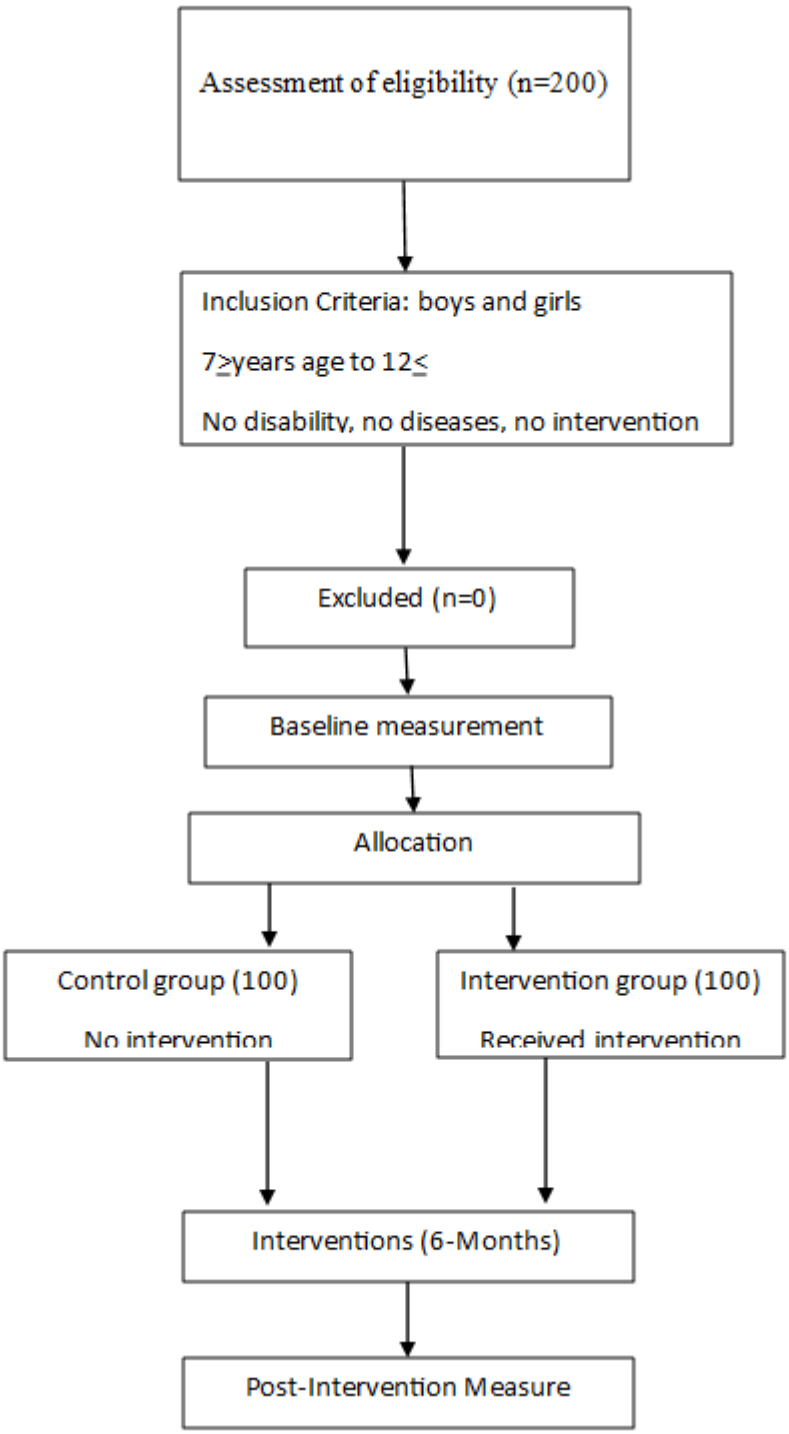


Figure 2: Inclusion and allocation of interventions (Participants)

Exempting conditions: The following sources and types of studies were excluded from the review: books and sections of books, research theses and dissertations, conference proceedings and abstracts, studies on healthy eating, studies involving irrelevant participants, studies on sedentary behavior, studies on active transportation, studies on disability, and studies focusing on overweight populations.

Measures and Data Collection

Measurements were recorded at baseline (T0) and six months from baseline (T1), corresponding to the completion of the intervention programs. Height was measured, body weight was recorded, and waist circumference was taken. The waist-to-height ratio was calculated. Body Mass Index (BMI) was determined according to the guidelines of the Centers for Disease Control and Prevention, by dividing weight in kilograms by the square of height in meters, adjusted for sex and age (McCarthy & Ashwell, 2006).

Intervention Programs

The intervention programs included the following components:

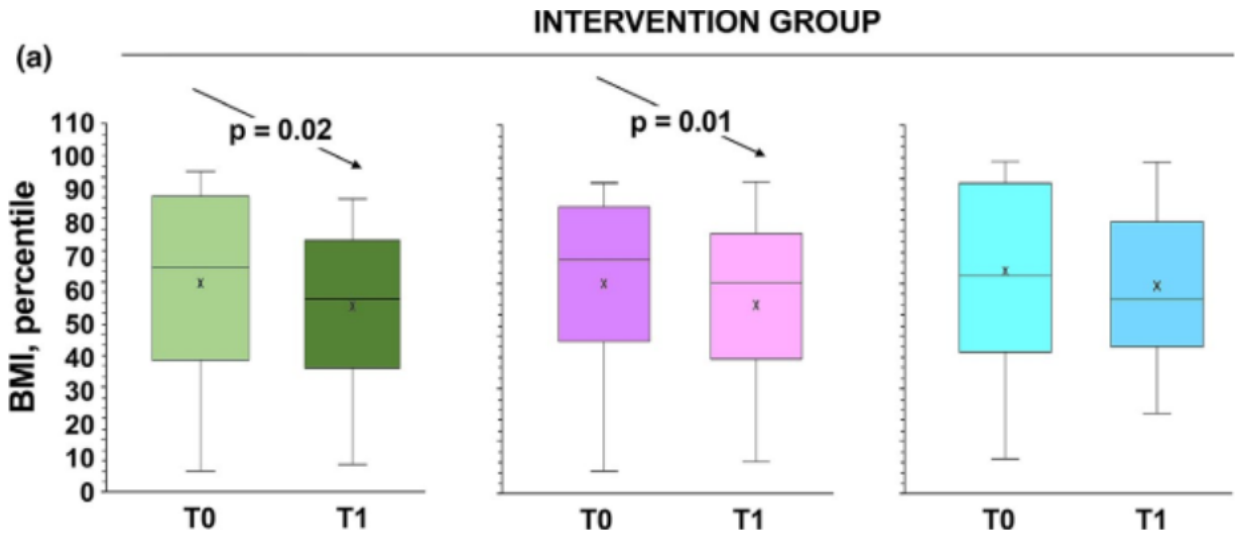
- **Types of exercises:** warm-up exercises and slow running.
- **Physical assessment test preparation:** standing high jump, standing long jump, and rope jump.
- **Training exercises:** endurance running, 30-meter sprints, push-ups (regular and on legs), and abdominal exercises.
- **Sport-specific preparation:** side run, back run, forward run, split run, runs with changes in direction, hand-joined ball throw, and right- and left-hand throwing.
- **Stretching exercises:** targeting upper limbs, lower limbs, and spine.

Analytical Approach

Statistical analysis was executed to assess the difference between the groups by running Mann-Whitney test.

Results and Discussion

BMI-Index



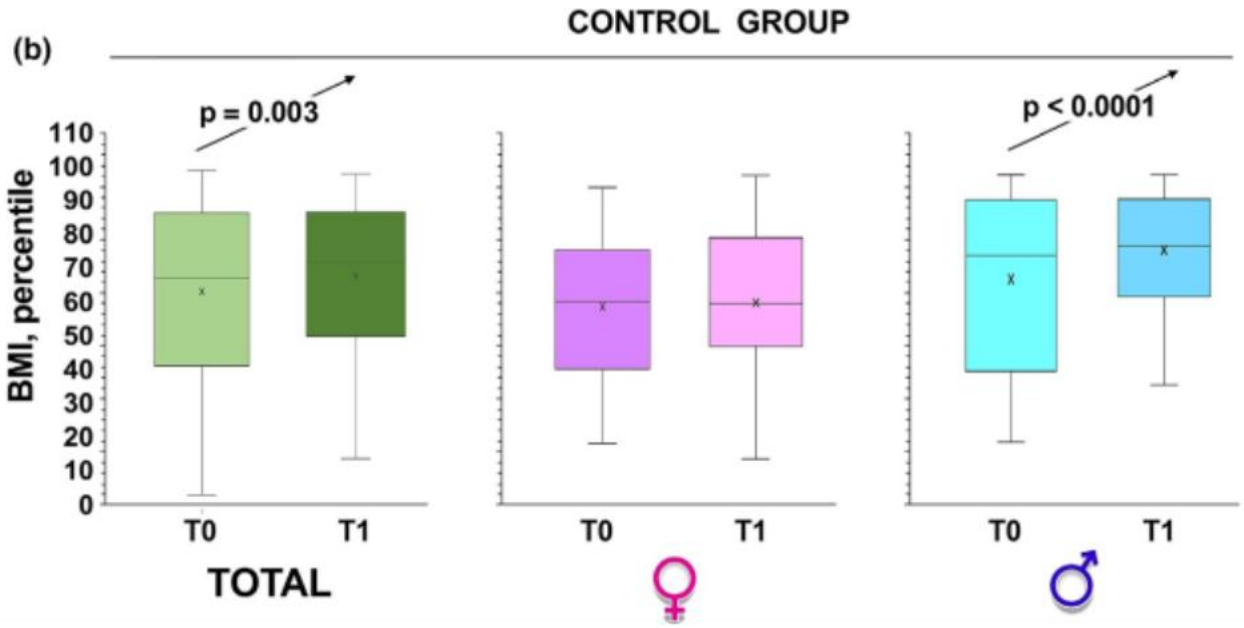


Figure 1: BMI index comparison

The change over time, body mass is presented in above figure by Box and whiskers, (a) presents the intervention groups, (b) is control group of children. T0 is the baseline and T1 is the completion line of 6 months. The sample was divided on the base of gender, the central box shows 50% of data value, between upper and lower quartiles. The bars show the extremes, while the central ine is at median, p-value were also obtained.

Table 1. Distribution of Participants by Weight Status at Baseline (T0) and Follow-Up (T1)

Group	Weight Status	T0 – All	T0 – Boys	T0 – Girls	T1 – All	T1 – Boys	T1 – Girls
Intervention	Underweight	5	2	3	0	0	0
	Normal weight	66	35	31	88	45	43
	Overweight	17	9	8	7	4	3
	Obesity	12	7	5	5	2	3
Control	Underweight	10	4	6	12	5	7
	Normal weight	60	41	19	52	32	20
	Overweight	15	4	11	19	7	12
	Obesity	15	7	8	17	9	

Table 1: Weight data

At baseline (T0), the majority of participants in the intervention group were of normal weight (66 participants), with smaller numbers classified as overweight (17), obese (12), or underweight (5). By the end of the intervention (T1), the number of normal-weight participants increased substantially to 88, while the prevalence of underweight, overweight, and obesity decreased to 0, 7, and 5 participants, respectively. Similar trends were observed when data were disaggregated by sex, with both boys and girls showing improvements in weight status. In contrast, the control group exhibited relatively stable weight distributions over the same period. Normal-weight participants slightly decreased from 60 to 52, while underweight and overweight categories increased modestly (underweight: 10 → 12; overweight: 15 → 19), and

obesity rose slightly from 15 to 17 participants. These findings suggest that the intervention was effective in promoting a shift towards normal weight among participants, whereas the absence of intervention in the control group was associated with minimal or unfavorable changes in weight status.

Waist Circumference

Changes in Waist Circumference

Waist circumference was measured at baseline (T0) and at 6 months follow-up (T1) for both intervention and control groups. Box-and-whisker plots illustrate the distribution and changes over time. Participants in the intervention group demonstrated a clear reduction in waist circumference, particularly among those classified as overweight or obese at baseline, whereas the control group showed minimal changes. These results indicate that the intervention was effective in reducing central adiposity and improving overall body composition.

Vertical Jump Performance

Vertical jump performance increased significantly in the intervention group following the 6-month program, as shown in the figure. Both boys and girls exhibited measurable improvements, highlighting enhanced lower-limb explosive strength as a result of the structured exercise intervention. In contrast, the control group showed no substantial change over the same period.

Rope Jump Performance

Rope jump results indicate significant improvements in the intervention group. Post-intervention measurements revealed enhanced coordination, endurance, and overall cardiovascular performance compared to baseline values. The control group demonstrated only minor changes, reinforcing the impact of the structured exercise program.

Strengths of the Study

This study provides valuable insights into the effects of structured physical activity interventions on school-aged children (7–12 years) who are physically inactive. By examining both physical fitness and body composition, the study addresses multiple dimensions of health, including muscular strength, endurance, and central adiposity. The equal allocation of boys and girls in intervention and control groups allowed for sex-based comparisons, enhancing the generalizability of the findings. Moreover, the study contributes to the understanding of practical strategies for improving physical activity among children and highlights potential benefits of school-based exercise programs.

Limitations

Several limitations should be considered. The study faced logistical challenges, including obtaining parental consent and maintaining student attendance throughout the 6-month intervention. Time and budget constraints limited the sample size and the scope of intervention activities. Additionally, the study focused on a specific age group and school setting, which may restrict generalizability to broader populations. Future studies should consider longer follow-up periods, larger sample sizes, and diversified intervention programs to further validate these findings.

Conclusion

This study aimed to evaluate the impact of a 6-month structured physical activity intervention on school-aged children who are physically inactive. The results demonstrated significant improvements in body composition, muscular strength, endurance, and coordination among participants in the intervention group, while the control group exhibited minimal changes. These findings underscore the importance of implementing regular, structured physical activity programs in school settings to promote healthy development and prevent long-term physical

and metabolic health issues. The study recommends the adoption of varied and engaging exercise interventions including aerobic, plyometric, functional, and resistance training to enhance physical fitness, maintain engagement, and mitigate the risks associated with childhood inactivity.

References

Ahn, S., & Fedewa, A. L. (2011). A meta-analysis of the relationship between children's physical activity and mental health. *Journal of Pediatric Psychology*, *36*(4), 385–397.

Almeida, M. B. de, Leandro, C. G., Queiroz, D. da R., José-da-Silva, M., Pessoa dos Prazeres, T. M., Pereira, G. M., das-Neves, G. S., Carneiro, R. C., Figueredo-Alves, A. D., & Nakamura, F. Y. (2021). Plyometric training increases gross motor coordination and associated components of physical fitness in children. *European Journal of Sport Science*, *21*(9), 1263–1272.

Alvarez-Bueno, C., Hillman, C. H., Cavero-Redondo, I., Sanchez-Lopez, M., Pozuelo-Carrascosa, D. P., & Martinez-Vizcaino, V. (2020). Aerobic fitness and academic achievement: A systematic review and meta-analysis. *Journal of Sports Sciences*, *38*(5), 582–589.

Bates, L. C., Zieff, G., Stanford, K., Moore, J. B., Kerr, Z. Y., Hanson, E. D., Barone Gibbs, B., Kline, C. E., & Stoner, L. (2020). COVID-19 impact on behaviors across the 24-hour day in children and adolescents: physical activity, sedentary behavior, and sleep. *Children*, *7*(9), 138.

Battaglia, G., Giustino, V., Tabacchi, G., Lanza, M., Schena, F., Biino, V., Giuriato, M., Gallotta, M. C., Guidetti, L., & Baldari, C. (2021). Interrelationship between age, gender, and weight status on motor coordination in Italian children and early adolescents aged 6–13 years old. *Frontiers in Pediatrics*, *9*, 738294.

Behm, D. G., Young, J. D., Whitten, J. H. D., Reid, J. C., Quigley, P. J., Low, J., Li, Y., Lima, C. D., Hodgson, D. D., & Chaouachi, A. (2017). Effectiveness of traditional strength vs. power training on muscle strength, power and speed with youth: a systematic review and meta-analysis. *Frontiers in Physiology*, *8*, 423.

Biddle, S. J. H., Ciaccioni, S., Thomas, G., & Vergeer, I. (2019). Physical activity and mental health in children and adolescents: An updated review of reviews and an analysis of causality. *Psychology of Sport and Exercise*, *42*, 146–155.

Bidzan-Bluma, I., & Lipowska, M. (2018). Physical activity and cognitive functioning of children: a systematic review. *International Journal of Environmental Research and Public Health*, *15*(4), 800.

Boak, A., Hamilton, H. A., Adlaf, E. M., Henderson, J. L., & Mann, R. E. (2018). The mental health and well-being of Ontario students, 1991-2017: detailed findings from the Ontario Student Drug Use and Health Survey (OSDUHS)(CAMH Research Document Series No. 47). *Toronto, ON: Centre for Addiction and Mental Health*.

Bülbül, S. (2020). Exercise in the treatment of childhood obesity. *Turkish Archives of Pediatrics/Türk Pediatri Arşivi*, *55*(1), 2.

Claver, F., Jiménez, R., Gil-Arias, A., Moreno, A., & Moreno, M. P. (2017). The cognitive and motivation intervention program in youth female volleyball players. *Journal of Human Kinetics*, *59*, 55.

Cox, E. P., O'Dwyer, N., Cook, R., Vetter, M., Cheng, H. L., Rooney, K., & O'Connor, H. (2016). Relationship between physical activity and cognitive function in apparently healthy young to middle-aged adults: A systematic review. *Journal of Science and Medicine in Sport*, *19*(8), 616–628.

Dale, L. P., Vanderloo, L., Moore, S., & Faulkner, G. (2019). Physical activity and depression, anxiety, and self-esteem in children and youth: An umbrella systematic review. *Mental Health and Physical Activity*, *16*, 66–79.

Ekelund, U., Tarp, J., Steene-Johannessen, J., Hansen, B. H., Jefferis, B., Fagerland, M. W., Whincup, P., Diaz, K. M., Hooker, S. P., & Chernofsky, A. (2019). Dose-response associations between accelerometry measured physical activity and sedentary time and all cause mortality: systematic review and harmonised meta-analysis. *Bmj*, *366*.

Faulkner, G., & Duncan, M. (2017). Physical activity and mental health: A focus on depression. In *Routledge handbook of physical activity policy and practice* (pp. 171–185). Routledge.

Feito, Y., Heinrich, K. M., Butcher, S. J., & Poston, W. S. C. (2018). High-intensity functional training (HIFT): definition and research implications for improved fitness. *Sports*, *6*(3), 76.

Fischetti, F., Cataldi, S., & Greco, G. (2019). A combined plyometric and resistance training program improves fitness performance in 12 to 14-years-old boys. *Sport Sciences for Health*, *15*, 615–621.

Guthold, R., Stevens, G. A., Riley, L. M., & Bull, F. C. (2020). Global trends in insufficient physical activity among adolescents: a pooled analysis of 298 population-based surveys with 1· 6 million participants. *The Lancet Child & Adolescent Health*, *4*(1), 23–35.

Haverkamp, B. F., Wiersma, R., Vertessen, K., van Ewijk, H., Oosterlaan, J., & Hartman, E. (2020). Effects of physical activity interventions on cognitive outcomes and academic performance in adolescents and young adults: A meta-analysis. *Journal of Sports Sciences*, *38*(23), 2637–2660.

Kao, S.-C., Westfall, D. R., Parks, A. C., Pontifex, M. B., & Hillman, C. H. (2017). Muscular and aerobic fitness, working memory, and academic achievement in children. *Med Sci Sports Exerc*, *49*(3), 500–508.

Karuc, J., & Mišigoj-Duraković, M. (2019). Relation between weight status, physical activity, maturation, and functional movement in adolescence: an overview. *Journal of Functional Morphology and Kinesiology*, *4*(2), 31.

Koekoek, J., & Van Hilvoorde, I. (2019). *Digital Technology in Physical Education*. Routledge.

Lipowski, M., Lipowska, M., Jochimek, M., & Krokosz, D. (2016). Resiliency as a factor protecting youths from risky behaviour: Moderating effects of gender and sport. *European Journal of Sport Science*, *16*(2), 246–255.

Lipowski, M., & Zaleski, Z. (2015). Inventory of Physical Activity Objectives–a new method of measuring motives for physical activity and sport. *Health Psychology Report*, *3*(1), 47–58.

McCarthy, H. D., & Ashwell, M. (2006). A study of central fatness using waist-to-height ratios in UK children and adolescents over two decades supports the simple message–'keep your waist circumference to less than half your height.' *International Journal of Obesity*, *30*(6), 988–992.

Peitz, M., Behringer, M., & Granacher, U. (2018). A systematic review on the effects of resistance and plyometric training on physical fitness in youth-What do comparative studies tell us? *PloS One*, *13*(10), e0205525.

Poitras, V. J., Gray, C. E., Borghese, M. M., Carson, V., Chaput, J.-P., Janssen, I., Katzmarzyk, P. T., Pate, R. R., Connor Gorber, S., & Kho, M. E. (2016). Systematic review of the relationships between objectively measured physical activity and health indicators in school-aged children and youth. *Applied Physiology, Nutrition, and Metabolism*, *41*(6), S197–S239.

Román, P. Á. L., Vallejo, A. P., & Aguayo, B. B. (2018). Acute aerobic exercise enhances students' creativity. *Creativity Research Journal*, *30*(3), 310–315.

Romeo, A., Edney, S., Plotnikoff, R., Curtis, R., Ryan, J., Sanders, I., Crozier, A., & Maher, C. (2019). Can smartphone apps increase physical activity? Systematic review and meta-analysis. *Journal of Medical Internet Research*, *21*(3), e12053.

Yuksel, H. S., Şahin, F. N., Maksimovic, N., Drid, P., & Bianco, A. (2020). School-based intervention programs for preventing obesity and promoting physical activity and fitness: a

systematic review. *International Journal of Environmental Research and Public Health*, *17*(1), 347.